NETL-RUA
Regional University Alliance

E NEWS

Shared Intellect • Shared Laboratories • Shared Resources

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# World Class NETL-RUA Signature Facility to be Developed at Penn State

A combined investment by United Technologies Corporation (UTC), the Department of Energy (DOE) National Energy Technology Laboratory (NETL), and the State of Pennsylvania will create the opportunity to build the most advanced stationary gas turbine testing facility in the United States. The new laboratory will give researchers the opportunity to model and perform laboratory testing on the next generation of gas turbine engines for improved fuel efficiency.

On September 23, NETL Director, Anthony Cugini, joined members of UTC's Pratt & Whitney Division and Penn State representatives to kick off the collaboration.

DOE has historically supported gas turbine research through extramural research with the gas turbine industry and the NETL Regional University Alliance (NETL-RUA). As an NETL-RUA partner, Penn State will help lead collaborative efforts focused on the design and construction of this new world-class test facility that will significantly enhance turbine research. New cooling improvement strategies for the turbine rotating blade platform will be a primary focus of the facility. A primary intent is to increase turbine efficiencies by using disruptive new designs in sealing stationary-rotating interfaces and cooling other hot gas parts including rotating airfoils. The main driver of this effort is to develop new designs that will lead to more efficient machines that use less fuel with better performance. The facility will include a full vane/blade/vane assembly. The assembly will be of a size and will operate at a rotating speed that will surpass any other similar facility in the world and allow the replication of operating conditions seen in modern gas turbine engines.

>> *See* **WORLD CLASS FACILITY**, *Page 2*

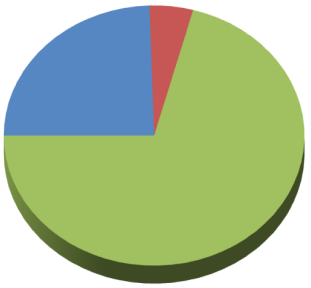
## NETL-RUA
## METRICS SNAPSHOT

| CURRENT R&D PORTFOLIO | |
|---|---|
| Total Active Projects | 188 |
| Project Award Value | $16,480,164 |

| PRODUCTS | FY2011 | FY2012 |
|---|---|---|
| Publications | 194 | |
| Patents | 11 | |
| Licenses | 9 | |
| Students Graduated | 20 PhD | |
| | 8 MS | |

* Products data is "updated quarterly"

**RESEARCH PERSONNEL**




November 2011

## *Welcome to Our First Issue!*

E News is your monthly source for the latest information about NETL-RUA's research, activities, and other important news. If you have information that you would like to feature in future newsletters, send that information to julianne.klara@netl.doe.gov.

## What's in This Issue



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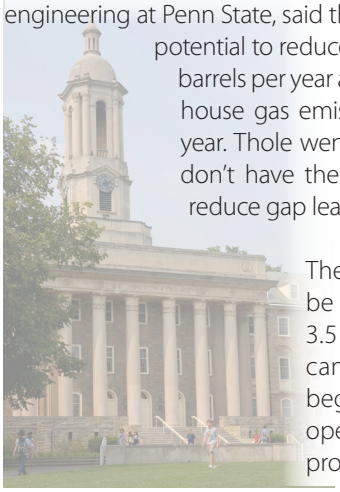
>> **WORLD CLASS FACILITY**, *Continued from Front Page*

In an article that appeared on Penn State's news website, *Live*, Dr. Karen Thole, professor and head of mechanical and nuclear engineering at Penn State, said that through this research there is the potential to reduce crude oil usage of about 25 million barrels per year and an associated reduction of green house gas emissions of 10 million metric tons per year. Thole went on to explain that current facilities don't have the ability to evaluate new designs to reduce gap leakage flows.



The Advanced Turbine Laboratory will be housed at Cato Park, approximately 3.5 miles from Penn State's main campus. Construction is slated to begin in FY2012 and shakedown and operational testing of this facility is projected for FY2013.

## Core R&D Funding News

On October 1st, the NETL entered its fiscal year 2012, which has necessitated some changes in the NETL-RUA research portfolio to accommodate both an anticipated reduction in our FE R&D budget, relative to FY 2011 levels, and some change in work scope mandated by our FE customer base. As you are no doubt aware, Congress has not yet finalized Department of Energy budgets for FY 2012, leaving final funding levels uncertain. It is not clear at this writing when final budgets will be passed. Nevertheless, field work proposals for an anticipated FY 2012 NETL-RUA research portfolio have been approved, and NETL and URS management are working together to develop and implement detailed work plans. As part of this process, URS is working with the universities to prepare and finalize plans for both new and on-going work, with new university projects targeted to begin on January 1, 2012.

For the Strategic Center for Coal, FY2012 NETL-RUA research will focus on Carbon Capture, Carbon Storage, Advanced Combustion, Turbine Thermal Management, Gasification, Innovative Process Technologies, the Carbon Capture Simulation Initiative (CCSI), the National Risk Assessment Partnership (NRAP), and the ARRA-funded Industrial Carbon Management Initiative (ICMI). No new Fuels or Fuel Cell research is currently planned for FY 2012, pending clarification from Congress on the fates of these two research programs. For the Strategic Center for Natural Gas & Oil, FY 2012 NETL-RUA research will focus on Unconventional (primarily Shale Gas) and Ultra-deepwater Resources, with a majority of the work funded through the EPACT 2005 complementary program.

As a result of expected decreases in funding and changes in research scope, FY2012 will represent a transition for many NETL-RUA projects and people, as old projects are closed out, some existing projects and people are continued, and a few new projects are started. Personnel displaced due to budget cuts and/or changes in scope have been moved to other projects where possible; however, such moves have not been possible in all cases. Such events emphasize that efforts for new growth and diversification of research beyond that funded by FE are necessary to making the collaborative successful over the longer term.

## Strategic Growth Area Update

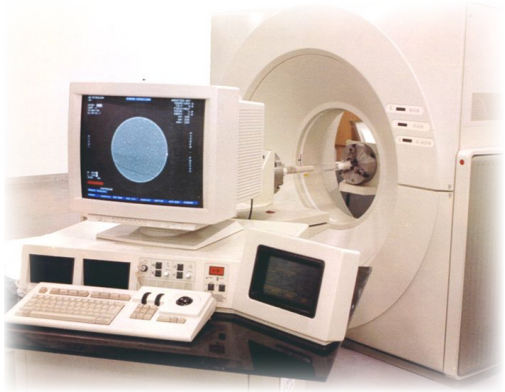
At the end of May 2011, NETL-RUA sponsored a workshop to discuss technology challenges and unique offerings that could be provided by the NETL-RUA for six technology areas: Grid Technologies, Rare Earths and Critical Materials, Shale Gas, Advanced Materials, Energy Storage, and Energy-Water Nexus. The focus was to look for new areas of mutual benefit that leverage the capabilities and relationships of the Alliance or offer an opportunity to build unique capabilities all toward the goal of growing and diversifying the R&D portfolio. In July, the Executive Committee made the decision to provide support to Grid Technologies and, at a lower level of support, Rare Earths and Critical Materials. To position ourselves for future growth, follow-on activities in Shale Gas, Advanced Materials, and Energy/Water Nexus were requested by the Executive Committee to better define potential opportunities. Each month, the newsletter will provide an update on the status of one of those Strategic Growth Areas (SGAs).

### Grid Technologies

The Grid Technologies strategic growth area was selected by the Executive Committee as it is well positioned in what is forecast to be a very large market for upgrading U.S. transmission and distribution systems, allows for broad participation from all members, is not dependent on winning a "hub" for sustainable growth, has the advantage of building upon a proven growth model, and is based on a strong strategy for technology development and market approach that includes regional support, students and alignment of interests and abilities of the Alliance. The plan for this area is focused on developing a Grid Technologies Collaborative (GTC) consisting of researchers from NETL-RUA and industry to execute a comprehensive program of fundamental research on *power electronics technologies* for transmission and distribution system applications; technology development, simulation, testing, and commercialization; and professional training for the advanced grid technologies sector. Plans for the first year focus on consolidating capabilities across the partner institutions and building a market and brand recognition for innovative R&D, technology integration, and training services. The Executive Committee is providing support for a business development/marketing expert to develop collateral material, to build relationships with industry, and to attend key meetings and symposia advertising capabilities of the GTC. A more comprehensive business plan and resource estimate will be presented by the team lead, Greg Reed (Pitt), at the quarterly meeting of the Executive Committee on November 9, 2011.

## NETL-RUA Paper Receives SPE Best Paper Award

Dual-energy CT-scanning is widely used in the medical industry in DEXA (dual-energy X-ray absorptiometry) systems for measuring bone mineral density after eliminating the effects of X-ray absorption by soft tissues. Dual-energy scanning has also been used quite successfully in fluid flow visualization studies. However, it has not been utilized fully in characterizing reservoir rocks and in particular coal, which, because of its widely variable number of components, provides a challenge for dual-energy CT scanning technology. Development of high purity calibration standards potentially expands the use of CT scanning technology on NETL-RUA research projects such as Enhanced Geothermal Systems Research with West Virginia University. This collaboration will help to understand which formations, through CT identification and quantification, will allow for the identification of the most suitable environment for geothermal systems operation and research.



*Dual-energy CT-scanner*

Recently, a research paper titled "Analysis of Calibration Materials to Improve Dual-Energy CT Scanning for Petrophysical Applications," co-authored by Dr. Dustin McIntyre of DOE, Dr. Jinesh Jain of URS, and university collaborators [Shameem Siddiqui (Texas Tech); Krishna Ayyalasomayajula (ORISE); JP Singh (Mississippi State); Fang Yu-Yueh (Mississippi State)] describes the steps taken to improve the quality of calibration standards used to perform mineral (and other material) identification applying to the geosciences. CT data are used to measure bulk density and porosity; to quantify heterogeneity; to make core-to-log comparisons for depth matching and log calibrations. Log calibration is important for correctly identifying mineral contents and generating lithology logs. Dual-energy CT provides a quick and easy way to calibrate the density and photoelectric logs. The paper has been well received and was awarded the best paper in an annual competition by the Society of Petroleum Engineers (SPE International).

The analysis performed by the NETL led research team utilizes both inductively coupled plasma optical emission spectroscopy (ICP-OES) and laser induced breakdown spectroscopy (LIBS) to identify and quantify contaminants within the calibration standards. The identification and quantification of the contaminants allows for the user to adjust the calibration scans to improve the accuracy of the dual energy CT measurements used for material identification in the geosciences.

## NETL and WVU Showcase AVESTAR Center

NETL has collaborated with industry and university experts to launch the world-class **Advanced Virtual Energy Simulation Training and Research (AVESTAR™) Center** located at NETL and West Virginia University (WVU), both in Morgantown, West Virginia. An open house and $CO_2$ capture simulator-based training session was held for the DOE's multi-lab Carbon Capture Simulation Initiative (CCSI) semi-annual review meeting. At the open house, the AVESTAR team provided live demonstrations of the Center's training system to more than 70 CCSI meeting participants, including members of the CCSI power industry advisory board and five collaborating DOE national labs, namely NETL, Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and Pacific Northwest National Laboratory.

Today, the AVESTAR Center offers a high-fidelity, real-time dynamic simulator for an Integrated Gasification Combined Cycle (IGCC) power plant with 90% pre-combustion $CO_2$ capture. The full-scope IGCC Operator Training System (OTS) provides training in a state-of-the-art control room environment, while the first-of-a-kind Immersive Training System (ITS) offers the trainee a realistic 3D virtual plant environment.

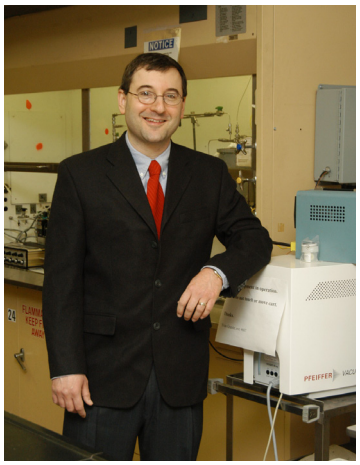
The AVESTAR Center provides NETL-RUA with the opportunity to offer comprehensive training for operators engineers, and managers, collaborate with energy experts on advanced research initiatives, enhance engineering education in process dynamics and control, and accelerate custom development of plant-specific simulators.

Leveraging the AVESTAR Center, NETL-RUA is leading efforts to develop dynamic simulation and control technology for the safe, reliable, and efficient operation of pre-, post-, and oxy-combustion carbon capture processes for industrial applications. Development of state-of-the-art dynamic modeling and simulation tools is expected to accelerate the widespread deployment of carbon capture technologies to hundreds of power plants.

*Operator Training Simulator for IGCC Power Plant with $CO_2$ Capture*

# NETL-RUA Researcher Receives Activated Carbon Hall of Fame Award

Dr. Evan Granite, NETL, received the 2011 Activated Carbon Hall of Fame Award given by Professional Analytical and Consulting Services, Inc. (PACS) at the 28th International Activated Carbon Conference held in Pittsburgh, PA, October 6-7.



PACS cited that Evan "has done outstanding work on the subject of mercury recovery from water and air, with special emphasis on the potential one-billion-dollar (USD) market for recovery of mercury from electric power plants burning coal and municipal incinerators practicing waste-to-wealth." Dr. Granite has been with NETL for almost fifteen years, working on activated carbon projects as well as other sorbent, catalyst, photochemical, and electrochemistry projects for separation of contaminants and carbon dioxide for coal-derived gas streams, and development of analytical techniques for on-line detection of trace concentrations of mercury, arsenic selenium, and phosphorus. Evan's expertise has most recently been applied to the goals of the NETL-RUA Membrane Research Team.

## Upcoming Events

| | |
|---|---|
| Nov 9, 2011<br>9–3 pm EST | Executive Committee Meeting |
| Nov 16, 2011<br>1–3 pm EST | Communications Committee Meeting |
| Nov 23, 2011<br>1–3 pm EST | Technology Transfer Committee Meeting |
| Dec 5, 2011<br>2–4 pm EST | Research Committee Meeting |
| Dec 6, 2011<br>2–4 pm EST | Education Committee Meeting |

## NETL-RUA Committee News

Six standing committees are charged with supporting NETL-RUA's research and educational mission through the collaborative implementation of program goals and day-to-day operations. Here's what the NETL-RUA Committees are up to:

The **Business Development Committee** is focused on developing and pursuing new business opportunities and funding sources to grow the NETL-RUA research portfolio and capabilities. So far, the NETL-RUA has won 3 new awards with a total value of $4.1 million. Funding sources for these projects include Department of Energy–EERE, Department of Interior–BOEMR, and Department of Energy–ARPA-E. Additionally, there are 13 proposals with a value of over $23 million still pending notification.

The **Communications Committee** is working to increase the visibility and impact of NETL-RUA both regionally and nationally by effectively communicating the objectives, results, and successes of the Alliance's activities. The Committee is currently developing brochures that are focused toward three main stakeholder audiences: the general public, Government leaders and Congress, and potential customers and partners for our research. Once completed, these will be posted on MOSS (Members Only Sharepoint Site) for all to use. The Committee has also solicited members for a Speaker's Bureau to serve as experts on various energy topics.

The **Education Committee** provides enhanced opportunities for NETL-RUA to prepare future generations of energy scientists, engineers, policy makers, and entrepreneurs in providing solutions for the nation's energy challenges through educational collaborations between NETL and the member universities. Keep an eye out in early 2012 for monthly technology seminars of the "brown bag" variety where we can eat lunch together while we listen to our colleagues talk about topics of both general interest and specific technologies.

The **Operations Committee** has facilitated changes to prescribed processes and contract requirements to increase operational efficiency and effectiveness of each university subcontract with URS. This Committee continues to work issues as they arise to improve the collaborative working environment.

The **Technology Transfer Committee**, the focus of which is on the management, dissemination, and commercialization of the intellectual assets created through the NETL-RUA, has leveraged its combined knowledge, experience, networks, and best practices to support energy innovation and entrepreneurship. The Committee is working on standard templates for intellectual property agreements and standard contract language in preparation for new business opportunities that may occur outside of NETL's current RES contract with URS and the universities.


The **Research and Development Committee** is charged with defining the long-term R&D portfolio to ensure fulfillment of the NETL-RUA program intent and research mission. Top researchers from all of the member organizations are working together to assess the current state of the science, identify grand challenges, and support efforts to match technology development with market needs. A joint meeting with the Business Development Committee is being planned for early next year to devise a plan for growing the R&D portfolio.